ATTACHMENT B

Excavation Safety

CONTENTS

1.0 PURPOSE

To establish safe operating procedures for the conduct of excavations

2.0 SCOPE

The Excavation Safety SOP applies to excavations which JMC employees and its subcontractors must enter and excavations that JMC creates to which the public or other employer's employees may be exposed to.

3.0 DEFINITIONS

Competent Person - one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees and has the authorization to take prompt corrective measures to eliminate them.

Cross-brace - horizontal member of shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation - any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal

Face - vertical or inclined earth surfaces formed as a result of excavation work.

Registered Professional Engineer (PE) - for the purposes of this SOP, registered engineer means an individual who is registered in any state as a professional engineer. A PE's review and approval is required when approving designs for "manufactured protective systems," and "tabulated data."

Shoring - a structure that supports the sides of an excavation and is designed to prevent cave-ins.

Sheeting - vertical members of a shoring system that are in contact with and retain the earth in position and in turn are supported by other members of the shoring system.

Shielding - a structure that is able to withstand the forces imposed on it by a cave-in and protect employees within the structure. Shields can be designed to be portable and moved along as work progresses or they can be designed as permanent. Trench boxes are common shield devices.

Soil Types - as defined by 29 CFR 1926

Type A - Cohesive Soils with an Unconfined Compressive Strength (UCS) of 1.5 tons/square foot (tsf). Examples of cohesive soils:

Clay
Silty Clay
Sandy Clay
Clay Loam
Cement Soil i.e. Hardpan

No soil is Type A if:

The soil is fissured;
The soil is subject to vibration from heavy traffic, pile driving, or similar effects;
The soil has been previously disturbed; or,
The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of 4H:1V or greater

Type B - Cohesive Soils with a UCS of > 0.5 tons/square foot or

Granular Cohesionless Soils including:
Angular Gravel
Silt
Silt Loam
Sandy Loam

Previously disturbed soils except those that would otherwise be classified as Type C

Soil that meets the UCS requirements for Type A but is fissured or subject to vibration

Dry rock that is not stable

Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than 4H:1V but only if the material would otherwise be classified as Type B.

Type C - Cohesive Soils with an UCS of $\leq$ 0.5 tons/square foot or

Granular Soils i.e. gravel, sand, and loamy sand
Submerged Soil or Soil from which Water is freely seeping

Submerged Rock that is not stable
Material in a Layered Systems where the layers dip into the excavation on a slope of 4H:1V or steeper

Upright - vertical member of a shoring system placed in contact with the earth and usually positioned so that individual members do not touch each other. Uprights placed so that individual members are closely spaced, in contact with each other or are interconnected are often called sheeting.

Wales - horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

4.0 RESPONSIBILITIES

In addition to responsibilities outlined in the JMC Corporate Health and Safety Manual and Site Specific Health and Safety Plan, excavation work imparts these additional responsibilities.

Project Management - is responsible for directing excavation activities in accordance with this SOP, providing necessary people, equipment and materials and obtaining necessary permits, utility clearances and approvals.

Site Health and Safety Officer - is the designated *competent person* on a JMC site, responsible for daily inspections of excavation work and having employees removed from excavations which are unsafe. In the absence of a SHSO, the project manager will serve as or will designate a *competent person* having the qualifications listed above.

5.0 PROCEDURE

5.1 ***Hazard Recognition*** - accident types which result from improper excavation work include trapped in a cave-in, falls to a different level, struck by objects falling into an excavation, contact with underground/ overhead utilities, and exposure to hazardous materials and atmospheres.

5.2 Hazard Controls

5.2.1 ***Training*** - JMC field employees (project managers, site supervisors, site health and safety officers, heavy equipment operators and technicians) will receive instruction in excavation safety which will enable

them to recognize unsafe excavations and the control measures necessary to make an excavation safe for entry and safe to work around.

5.2.2 ***Sloping*** - protection of employees in excavations greater than or equal to five feet in depth may be accomplished by sloping the faces of an excavation in accordance with one of the following four options:

Default Slope1.5:1 (H:V) - Simple excavations (no vertical sided lower portion) twenty feet deep or less may be sloped at an angle of 1.5:1. Excavations 20 feet deep or less with vertical sided lower portions will be shielded to a height at least 18 inches above the top of the vertical sides.

Sloping Based on Soil Type - Excavations may be sloped in accordance with soil classifications. Type A soils - 3/4:1, Type B soils - 1:1 and Type C soils - 1.5:1. Special considerations apply to layered soil deposits Soil classifications must be made using at least one visual and one manual soil classification method. Criteria for each soil type and a description of soil classification methods are described in Appendix A of OSHA's excavation standard and is available from the JMC Health and Safety Director.

Alternative Soil Classification and Sloping Systems - Alternative soil classification and sloping systems may be developed. The JMC Corporate Health and Safety Director and a PE must approve them.

Site Specific Sloping and Benching Systems - Site specific benching and sloping designs may be developed in place of the alternatives listed above. The JMC Corporate Health and Safety Director and a PE must approve the design.

5.2.3 ***Shoring/ Shielding*** - protection of employees in excavations greater than or equal to five feet in depth may be accomplished by shoring or shielding techniques. Shoring systems are designed to prevent cave-ins and shielding systems are designed to protect people within an excavation should a failure occur. Options for the protection of employees in excavations are:

- systems (timber shoring or aluminum hydraulic shoring) designed in accordance with Appendices A C & D of 29 CFR 1926 Subpart P for excavations less than or equal to 20 feet deep. (no PE approval required);
- aluminum hydraulic shoring used in accordance with the manufacturer's instructions;
- trench boxes used in accordance with the manufacturer's instructions; and,
- other systems approved by the JMC Corporate Health and Safety Director and a PE.

5.2.4 ***Utility Surveys*** -The location of utilities will be determined prior to the start of an excavation. Utility companies and owners will be advised of excavation activities and asked to locate underground utilities in the vicinity of the excavation.

5.2.5 ***Access and Egress*** - Stairways, ladders, or ramps will be placed so as to require no more than 25 feet of lateral travel for employees. Soil ramps must be at a slope which allows for upright walking into and out of the excavation.

5.2.6 ***Fall Protection*** - Employees will be protected against materials falling into an excavation in which they are working and protected from falling into excavations.

- employees will not be allowed to work underneath loads handled by a lifting or excavating equipment
- employees must maintain safe distances from trucks being loaded with soil to avoid being stuck by spillage
- when equipment is required to approach the edge of an excavation and the operator does not have a clear unobstructed view of the excavation edge, a warning system such as barricades, hand signals or stop logs. When possible the grade of the equipment's approach should be away from the excavation.
- employees will be protected from loose rock and soil rolling into the excavation by scaling, or barricades. Excavated soils and other materials will be staged no closer than 2 feet from the edge of the excavation.

5.2.7 ***Stability of Adjacent Structures*** - When the stability of a structure adjacent to an excavation is endangered, shoring, bracing, or underpinning will be used to ensure the stability of the structure for the protection of employees. Excavation below the level of the base or footing of a structure which may pose a hazard to employees is permitted only when:

- a support system is provided to ensure the safety of employees;
- a PE has approved the determination that the structure is far enough away from the excavation so as to be unaffected; or,
- a PE approves the determination that the excavation work does not pose a hazard to employees.

5.2.8 ***Daily Inspections*** - A competent person will conduct daily inspections of excavations, adjacent areas and protective systems for evidence of a situation that could result in possible cave-ins, failure of a protective system, and hazardous atmospheres. Inspections will be conducted prior to the start of work in and around the excavation and as required throughout a shift. Inspections will be made after every

rainstorm and any other incident which potentially decreases the degree of safety with which the excavation may be entered.

When a condition is discovered during an inspection which could result in a possible cave-in, protective system failure or development of a hazardous atmosphere, exposed employees will be removed from the hazardous area until the problem is corrected.

5.2.9 ***Application of HAZWOPER SOP's*** - Excavations conducted on JMC sites covered under OSHA's Hazardous Waste Operations and Emergency Response Standard (HAZWOPER) are subject to 29 CFR 1910.120.

5.2.10 ***Application of Confined Space Entry SOP*** - Excavations which may pose hazards associated with confined space entry (e.g. hazardous atmospheres) will be subject to the JMC Standard Operating Procedure for Confined Space Entry.

5.2.11 ***Minimum Clearance from Energized Overhead Electric Lines*** - operations adjacent to overhead lines are prohibited unless at least one of the following conditions is satisfied:

- power has been shut off and positive means taken to prevent the lines from being energized; or,
- equipment or any part, does not have the capability of coming within the minimum clearance from the energized overhead lines as specified below.

System Voltage	Minimum Required Clearance
0 -50 kV	10 ft.
51 - 100 kV	12 ft.
101- 200 kV	15 ft.
201 - 300 kV	20 ft.
301- 500 kV	25 ft.
501 - 750 kV	35 ft.
751 - 1000 kV	45 ft.

6.0 REFERENCES

29 CFR 1926 Subpart P

7.0 ATTACHMENTS

None

8.0 RECORD KEEPING

Inspections
Employee training events

9.0 EQUIPMENT

See SOP contents

JMC ENVIRONMENTAL CONSULTANTS, INC.

EXCAVATION CHECKLIST

(To be completed by a "Competent Person" prior to personnel entry into an excavation ≥5 ft. deep, each day and after rain events before entry)

SITE LOCATION: 511 13th Street, Carlstadt, NJ			
DATE:	**TIME:**	**COMPETENT PERSON:**	
SOIL TYPE (See attached form):			
SOIL CLASSIFICATION:	**EXCAVATION DEPTH:**	**EXCAVATION WIDTH:**	
TYPE OF PROTECTIVE SYSTEM USED:			

(Indicate for each of the following items: YES, NO, or N/A for not applicable)

1. General Inspection of Jobsite:	
A. Excavations, adjacent areas, and protective systems inspected by a competent person daily prior to the start of work.	
B. Competent person has the authority to remove employees from the excavation immediately.	
C. Surface encumbrances removed or supported.	
D. Employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation.	
E. Hard hats worn by all employees.	
F. Spoils, materials, and equipment set back at least 2 feet from the edge of the excavation.	
G. Barriers provided at remotely located excavations, wells, pits, shafts, etc.	
H. Walkways and bridges over excavations 4 feet or more in depth are equipped with standard guardrails and toeboards.	
I. Warning vests or other highly visible clothing provided and worn by employees exposed to public vehicular traffic.	
J. Employees required to stand away from vehicles being loaded or unloaded.	
K. Warning system established and utilized when mobile equipment is operating near the edge of the excavation.	
L. Employees prohibited from going under suspended loads.	
M. Employees prohibited from working on the faces of sloped or benched excavations above other employees.	
2. Utilities:	
A. Utility companies contacted and/or utilities located.	
B. Exact location of utilities marked.	
C. Underground installations protected, supported, or removed when excavation is open.	

Excavation Checklist (Continued)

3. Means of Egress:	
A. Lateral travel to means of egress no greater than 25 ft. in excavations, 4 ft. or more in depth.	
B. Ladders used in excavations secured and extended 3 ft. above the edge of the trench.	
C. Structural ramps used by employees designed by a competent person.	
D. Structural ramps used for equipment designed by a registered professional engineer.	
E. Employees protected from cave-ins when entering or exiting the excavation.	
4. Wet Conditions:	
A. Precautions taken to protect employees from the accumulation of water.	
B. Water removal equipment monitored by a competent person	
C. Surface water run-off diverted or controlled to prevent accumulation in the excavation.	
D. Inspections made after every rainstorm or other hazard increasing occurrence prior to re-entry.	
5. Hazardous Atmosphere:	
A. Atmosphere within the excavation tested where there is a reasonable possibility of an oxygen deficiency, combustible, or other harmful contaminant exposing employees to a hazard.	
B. Adequate precautions taken to protect employees from exposure to an atmosphere containing less than 19.5% oxygen and/ or to other hazardous atmospheres.	
C. Ventilation provided to prevent employee exposure to an atmosphere containing flammable gas in excess of 10% of the lower explosive limit of the gas.	
D. Testing conducted often to ensure that the atmosphere remains safe.	
E. Emergency equipment, such as breathing apparatus, safety harness and lifeline, and/ or basket stretcher readily available where hazardous atmospheres could or do exist.	
F. Employees trained to use personal protective equipment and other rescue equipment.	
G. Safety harness and lifeline used and individually attended when entering bell bottom or other deep confined excavations.	

Excavation Checklist (Continued)

6. Support Systems	
A. Materials and/ or equipment for support systems selected based on soils analysis, trench depth, and expected loads.	
B. Materials and equipment used for protective systems inspected and in good condition.	
C. Materials and equipment not in good condition have been removed from service.	
D. Damaged materials and equipment used for protective systems inspected by a registered professional engineer (RPE) after repairs and before being placed back into service.	
E. Protective systems installed without exposing employees to the hazards of cave-ins, collapses.	
F. Members of support system securely fastened to prevent failure.	
G. Support systems provided to insure stability of adjacent structures, buildings, roadways.	
H. Excavation below the level of the base or footing supported, approved by an RPE	
I. Removal of support systems progresses from the bottom and members are released slowly as to note any indication of possible failure.	
J. Backfilling progresses with removal of support system.	
K. Excavation of material to a level no greater than 2 feet below the bottom of the support system and only if the system is designed to support loads calculated for full depth.	
L. Shield system placed to prevent lateral movement.	
M. Employees are prohibited from remaining in shield system during vertical movement.	

CORRECTIVE ACTION AND REMARKS:

JMC ENVIRONMENTAL CONSULTANTS, INC.
SOILS ANALYSIS CHECKLIST

This checklist must be completed when soil analysis is made to determine the soil type(s) present in the excavation. A separate analysis must be performed if the excavation (trench) is stretched over a distance where soil type changes.

SITE LOCATION: 511 13th Street, Carlstadt, NJ		
DATE:	**TIME:**	**COMPETENT PERSON:**
WHERE WAS THE SAMPLE TAKEN FROM:		
EXCAVATION DEPTH:	**EXCAVATION WIDTH:**	**EXCAVATION LENGTH:**
VISUAL TEST		
Particle type: Fine grained (cohesive) _____	Granular (sand/silt or gravel) _____	
Water conditions: Wet _____	Dry _____	Seeping Water _____
Surface water present _____	Submerged _____	
Previously disturbed soils: Yes _____	No _____	
Underground utilities: Yes _____	If yes, what type?	
No _____		
Layered soils? **Note:** The less stable layer controls soil type. Yes _____	No _____	
Layered soils dipping into excavation: Yes _____	No _____	Unknown _____
Excavation exposed to vibrations: Yes _____	No _____	
If yes, from what?		
Crack like openings or spalling observed: Yes _____	No _____	
Conditions that may create a hazardous atmosphere: Yes_____	No _____	
If yes, identify condition and source:		
Surface encumbrances: Yes _____	No _____	If yes, what type?
Work to be performed near public vehicular traffic: Yes _____	No _____	
Possible confined space exposure: Yes _____	No _____	
MANUAL TEST		
Plasticity: Cohesive _____	Non-cohesive _____	
Dry strength: Granular (crumbles easily) _____	Cohesive (broken with difficulty) _____	
Wet shake: Water comes to surface (granular material) _____	Surface remains dry (clay material) _____	

SOILS ANALYSIS CHECKLIST (CONTINUED)

NOTE: The following unconfined compressive strength tests should be performed on undisturbed soils.
Thumb Test used to estimate unconfined compressive strength of cohesive soil:

Test performed: Yes _____	No _____
_____ Type A - soil indented by thumb with very great effort.	
_____ Type B - soil indented by thumb with some effort.	
_____ Type C - Soil easily penetrated several inches by thumb with little or no effort. If soil is submerged, seeping water, subjected to surface water, runoff, exposed to wetting.	

Penetrometer or Shearvane used to estimate unconfined compressive strength of cohesive soils:

Test performed: Yes _____	No _____ Device used:
_____ Type A - soil with unconfined compressive strength of 1.5 tsf or greater.	
_____ Type B - soil with unconfined compressive strength greater than 0.5 tsf and less than 1.5 tsf.	
_____ Type C - soil with unconfined compressive strength of 0.5 tsf or less. If soil is submerged, seeping water, subjected to surface water, runoff, exposed to wetting.	

NOTE: Type A - no soil type A if soil is fissured, subject to vibration, previously disturbed, layered dipping into excavation on a slope of 4H:1V.

SOIL CLASSIFICATION			
Stable Rock _____	Type A _____	Type B _____	Type C _____
SELECTION OF PROTECTIVE SYSTEM			
Protective System:	_____ Sloping (max. 20 ft. deep)	Specify angle _____	
	_____ Timber shoring		
	_____ Aluminum hydraulic shoring		
	_____ Trench shield	Maximum depth in this soil _____	

NOTE: Although OSHA will accept the above tests in most cases, some states will not. Check your state safety requirements for trenching regulations.

JMC ENVIRONMENTAL CONSULTANTS, INC.

DAILY TRENCHING LOG

DATE:	**SIGNATURE:**
WEATHER:	**PROJECT:**
Was **One Call System** contacted?	Yes _____ No _____
Protective system: Trench shield (box) _____ Sloping _____	Wood shoring _____ Other _____
Purpose of trenching: Drainage _____ Sewer _____ Other _____	Water _____ Gas _____
Were visual soil tests made? Yes _____ If yes, what type:	No _____
Were manual soil tests made? Yes ____ If yes, what type?	No _____
Type of soil: Stable Rock _____ Type A ____	Type B _____ Type C _____
Surface encumbrances? Yes _____ If yes, what type?	No _____
Water conditions: Wet _____ Dry ___	Submerged _____
Hazardous atmosphere exists? Yes _____ No _____ **(If yes, follow confined space entry procedures policy, complete Confined Space Entry Permit, monitor for toxic gas(s)**	
Is trenching or excavation exposed to public vehicular traffic (exhaust emission)? Yes _____ No _____ **(If yes, follow confined space entry procedures policy, complete Confined Space Entry Permit, monitor for toxic gas(s)**	
Measurements of trench: Depth_____	Length _____ Width _____
Is ladder within 25 feet of all workers? Yes __	No _____
Is excavated material stored 2 feet or more from edge of excavation? Yes _____	No_____
Are employees exposed to public vehicular traffic?**(If yes, warning vests required)**	Yes _____ No _____
Are other utilities protected: **(Water, sewer, gas or other structures)**	Yes _____ No _____
Are sewer or natural gas lines exposed? **(If yes, refer to confined space entry procedures policy, complete Confined Space Entry permit, monitor for toxic gas(s)**	Yes _____ No _____
Periodic inspection: Yes _____ No ___	Last (date) _____
Did employees receive training in excavating?	Yes _____ No _____

ATTACHMENT C

JMC SOP "Heat Stress"

CONTENTS

1.0 PURPOSE

The Heat Stress Management SOP is intended to describe measures which will reduce the probability of workers experiencing a heat related disorder.

2.0 SCOPE

The Heat Stress Management SOP is applicable to all JMC project sites. Its implementation is mandatory when workers wearing impermeable personal protective equipment are exposed to ambient air temperatures above 70^{o}F.

3.0 DEFINITIONS

Stress can contribute significantly to accidents or harm workers in other ways.

The term "stress" denotes the physical (gravity, mechanical force, heat, cold, pathogens, injury) and psychological (fear, anxiety, crises, joy) forces that are experienced by individuals.

They body's response to stress occurs in three stages:

a. Alarm Reaction - The body recognizes the stress and the pituitary-adreno-cortical system responds by increasing the heart rate and blood sugar level, decreasing digestive activity and dilating the pupils.

b. Adaptive Stage - The body repairs the effect of stimulation and stress symptoms disappear.

c. Exhaustion Stage - The body can no longer adapt to stress and the individual may develop emotional disturbances and cardiovascular and renal diseases.

The most common types of stress that affect remediation personnel are heat stress and cold stress. Heat and cold stress can be the most serious hazards an employee encounters at hazardous waste sites.

Heat Stress usually is a result of protective clothing decreasing natural body ventilation, although it may occur at any time work is being performed at elevated temperatures.

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur ranging from mild (such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement) to fatal. Because heat stress is one of the most common and potentially serious illnesses at hazardous waste sites, regular monitoring and other preventative measures are vital.

Site workers must learn to recognize and treat various forms of heat stress.

4.0 RESPONSIBILITIES

The Project Manager/ Supervisor is responsible for directing work in accordance with this procedure when implementation conditions are met. The PM is also responsible for providing resources necessary for implementation of the procedure.

The Site Health and Safety Officer is responsible for monitoring and facilitating employee compliance with the procedure. The SHSO is responsible for instructing employees in the recognition and control of heat related illnesses.

5.0 PROCEDURE

5.1 Symptom Recognition and Treatment

A large portion of heat stress control lies in the ability of an individual to recognize heat stress symptoms in themselves and co-workers. Early recognition and treatment of heat stress symptoms can prevent the development of more serious, debilitating and even life threatening conditions.

5.1.1 Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the heat regulating mechanisms of the body. The individual's temperature control system that causes sweating stops working correctly. Body temperature rises so high that brain damage and death will result if the person is not cooled quickly. Heat stroke requires medical attention.

a. Symptoms - Red, hot dry skin, although person may have been sweating earlier. Nausea, dizziness, confusion, extremely high body temperature, rapid respiratory and pulse rate, convulsions, unconsciousness, or coma.

b. Treatment - Cool the victim quickly. If the body temperature is not brought down fast, permanent brain damage or death will result. Soak the victim in cool, but not cold, water; sponge the body with cool water; or pour water on the body to reduce the temperature to a safe level ($102^{o}F$). Observe the victim and obtain medical help. Do not give coffee, tea, or alcoholic beverages. Do give fluids by mouth if victim is in and out of consciousness

5.1.2 Heat Exhaustion

Heat exhaustion is a state of very definite weakness or exhaustion caused by the loss of fluids from the body. This condition is much less dangerous than heat stroke, but it nonetheless must be treated.

a. Symptoms - Pale, clammy moist skin, profuse perspiration and extreme weakness. Body temperature is normal, pulse is weak and rapid, breathing is shallow. The person may have a headache, may vomit, and may be dizzy.

b. Treatment - Remove the person to a cool, air-conditioned place, loosen clothing, place in a head-low position, and provide bed rest. Consult a physician, especially in severe cases. The normal thirst mechanism is not sensitive enough to ensure body fluid replacement. Have the patient drink one to two cups of water immediately and every 20 minutes thereafter until symptoms subside. Total water consumption should be about one to two gallons per day.

5.1.3 Heat Cramps

Heat cramps are caused by perspiration that is not balanced by adequate fluid intake. Heat cramps are often the first sign of a condition that can lead to heat stroke.

a. Symptoms - Acute painful spasms of voluntary muscles: e.g., abdomen and extremities.

b. Treatment - Remove the victim to a cool area and loosen clothing. Have the patient drink one to two cups of water immediately and every 20 minutes thereafter until the symptoms subside. Total water consumption should be one to two gallons per day. Consult your physician.

5.1.4 Heat Rash

Heat rash is caused by continuous exposure to heat and humid air and is aggravated by chafing cloths. The condition decreases the ability to tolerate heat.

a. Symptoms - Mild red rash, especially in areas of body in contact with protective gear.

b. Treatment - Decrease the amount of time in protective gear and provide powder to help absorb moisture and decrease chafing.

5.2 Heat Stress Prevention Measures

What follows is a list of heat stress prevention measures which reduce the risk of an employee experiencing a heat related disorder. They are in no particular order. Successful heat stress prevention will require the implementation of all the control measures listed to varying degrees. No single control measure will prove to be either effective or efficient for a given project site.

5.2.1 Fluid Replacement

Have workers drink 16 ounces of water before beginning work, such as in the morning or after lunch. Provide disposable, four ounce cups and water that is maintained at 50 to 60^{O}F. Urge

workers to drink one to two gallons per day. To assist employees track their own fluid replacement, provide individual water coolers/ containers, fill the containers each day, and check consumption at the end of the day. The use of paper cups and a single cooler for the entire job site are difficult for both supervisors and employees to track. Provide cool, preferably air-conditioned, area for rest breaks. Discourage the use of alcohol in nonworking hours and discourage the intake of coffee during working hours. Monitor for signs of heat stress.

Use of electrolyte containing fluids (e.g., Gatorade) is more important for unacclimatized workers than acclimatized workers.

5.2.2 Acclimate Crew Members

Acclimatization is the process by which the body adapts to heat stress. Changes include increased sweating efficiency (earlier onset of sweating, increased sweat production, lower electrolyte loss) and stabilized blood circulation (less likelihood of blackout, dizziness, spots, etc.) It occurs with brief (~100 minutes) daily exposures to heat in 5 -7 days. Benefits of acclimatization are typically lost with no heat exposure for a week or more.

5.2.3 Reduce Heat Load (both environmental and metabolic)

Provide cooling devices to aid body cooling (i.e., Cool Vests). These devices, however, add weight, and their use should be balanced against worker efficiency.

Evaporative cooling is aided by clothing which wicks away perspiration from the skin. Long cotton underwear acts as a wick to help absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing. However, long cotton underwear is of no use and can aggravate heat stress symptoms once it becomes soaked with perspiration.

Install mobile showers and/or hose-down facilities to reduce body temperature and cool protective clothing.

In hot weather, conduct field activities in the early morning or evening.

Reduce metabolic heat load by designing tasks such that employee exertion is kept to a minimum

Reduce environmental heat loads by reducing radiant heat exposure (sunshine). Working in shaded areas and taking breaks in shaded areas will reduce heat loads due to radiant heat.

5.2.4 Employee Rotation

In hot weather, rotate shifts of workers wearing impervious clothing. On project sites with large crews, stagger heat stress breaks so that tasks are not completely shut down. On sites with small crew sizes this may not be possible due to the "buddy system" rule.

5.2.5 Dry Clothing and Personal Hygiene

Good hygienic standards must be maintained by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

5.2.6 Avoid Diuretics and Stimulants

Avoid consuming alcoholic beverages which cause loss of body fluid water by urination. Avoid consumption of stimulants such some cold medicines, caffeine and ephedrine which increase heart rates.

5.2.7 Heat Stress Monitoring and Work/ Rest Cycle Management

For strenuous field activities that are part of on-going work activities in hot weather, the following procedures shall be used to monitor the body's physiological response to heat and to manage the work/ rest cycle. These procedures are to be instituted when ambient temperatures exceed $70^{O}F$ and employees are wearing impervious (i.e., does not allow perspiration to evaporate) clothing (e.g., Tyvek, Saranex, PE Coated Tyvek, etc., coveralls).

a. Measure Heart Rate (HR) - The heart rate should be measured by the radial pulse at the wrist for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats per minute. If the HR is higher, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats per minute at the beginning of the next rest period, the following work cycle should be further shortened by 33%. The procedure is continued until the rate is maintained below 110 beats per minute.

b. Measure Body Temperature - Body temperature should be measured orally or aurally by a clinical thermometer as early as possible in the resting period. The temperature (OT) at the beginning of the rest period should not exceed $99.6^{O}F$, if it does, the next work period should be shortened by 33% while the length of the rest period stays the same. If the OT exceeds $99.6^{O}F$ at the beginning of the next period, the following work cycle should be further shortened by 33%. The procedure is continued until the body temperature is maintained below $99.6^{O}F$. Consuming fluids immediately prior to temperature measurement will give false, low readings. No one will continue to be exposed to hot conditions with an oral/ aural temperature in excess of 100.6F.

c. Rest Areas - Rest areas should be air conditioned if possible. The heart rates of workers who recover in air conditioned areas will be reduced faster and to lower rates than those that recover in non-air conditioned areas.

d. Manage Work/Rest Schedule - The following work/rest schedule shall be used as a guideline:

Active Work Time Using

Adjusted Temperature (^{O}F)	Impermeable Protective Gear
75 or less	50
80	40
85	30
90	20
95	10
100	0

To calculate the adjusted temperature:
T (adjusted) = T (actual) + (13 X fraction sunshine)
Measure the air temperature with a standard thermometer. Estimate the fraction of sunshine by judging what percent the sun is out: 100% sunshine = no cloud cover = 1.0, 50% sunshine = 50% cloud cover = 0.5, and 0% sunshine = full cloud cover = 0.0.
Reduce or increase the work cycle according to the guidelines under heart rate and body temperature.

6.0 REFERENCES

- Occupational Safety and Health and Guidance Manual for Hazardous Waste Site Activities
- Patty's Industrial Hygiene and Toxicology, Fourth Edition
- OSHA Web Site http://www.osha-slc.gov/SLTC/heatstress/index.html

7.0 ATTACHMENTS

None

8.0 EQUIPMENT

- Oral thermometers and hygienic slip covers or aural thermometers with hygienic slip covers
- Thermometer to measure air temperature
- Cool water and/ or electrolyte containing fluids (e.g., Gatorade)
- Ice cooled vests
- Materials to create shaded work areas